An Improved Method for Localization in WSNs based on Meta-heuristics Optimization Algorithm

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Introduction:

A sensor field made up of sensor nodes, base stations, and radio receivers for numerous multipurpose purposes and applications makes up a wireless sensor network. When electricity is applied, each node can function as a single node because it has a memory, sensors, an analogue to digital converter, and a micro controller transmitter. This serves as a means of spotting tracking, and keeping an eye on numerous real-world applications [1]. Despite the fact that they have numerous problems and restrictions related to their short battery life because the entire architecture is powered solely by electricity. The network's performance is impacted by a limited power supply, which raises the number of dead nodes. The performance of the network and the lifetime of the network both suffer as the number of dead nodes rises [2]. Many researchers offered effective models for improved WSN performance to achieve the same goal. WSN has uses in a variety of industries, including the healthcare, military aviation, and telecommunications. Consequently, it is important to evaluate and research how WSNs perform using different optimisation strategies. [3]. An essential class of methods for solving real-world optimisation issues in WSNs with high computational complexity is known as the metaheuristic approach. These approaches are designed to rapidly deliver close to optimal answers to difficult optimisation problems. Their benefits include simplicity in execution, speed in reaching answers, and resistance to changes in the nature of the problem [4]. In Wireless Sensor Networks (WSNs), meta-heuristic algorithms are known for creating new algorithms and optimising various features. In the majority of complex situations, evaluating a wide range of potential solutions is necessary to arrive at a precise solution. Within reasonable time restrictions, metaheuristic algorithms can find solutions. By maximising various variables like network coverage rate and energy consumption, these algorithms play a practical role in operationally solving such difficulties. Additionally, these indicators have a significant impact on network longevity.

Literature Review:

The sheer number of researchers engaged in WSN research and the metaheuristic appear promising in terms of producing achievements.

Finding sensor nodes in a dispersed wireless sensor network (WSN) is a genuine challenge, according to Aloor Gopakumar et al. [5]. PSO and tabu search are employed in WSN to enhance localization. The various WSN parameters, such as anchor density, range measurement errors, position uncertainty, etc., are also studied in this article. Experimental verification of the Tabu search and PSO results reveals enhanced efficiency and coverage**.**

Sankalp Arora et al. [6] devised a technique based on the BOA node optimisation algorithm to predict the position of the sensor nodes in WSN. The simulation was run using the suggested algorithm, PSO, and FA, and the results revealed that the suggested approach outperformed the other two algorithms in terms of localization error, localised nodes, and computation time.

A method was put forth by Sonia Goyal et al. [7] to address the issue of node localization in a wireless sensor network. The accuracy of node localization is assessed using a modified version

of the BAT method. When putting the algorithm into practise, consistency of the parameters, particularly emission rate and frequency, is crucial. The authors suggested performing a performance comparison of the suggested solution and the ones already in use as future work.

Any data gathered without knowing the location of the sensor nodes is erroneous and useless, according to Arsic et al [8]. They used the fireworks algorithm to provide the answer for the problem. The results of comparing the suggested firework algorithm with the traditional PSO reveal that errors were minimised; as a result, it offers a good tool for WSN localization issues.

For a more precise and energy-efficient way to locate sensor nodes, Fidonova et al. [9] concentrated on the network's whole coverage area. For the same, the authors suggested a multiple-objective ACO algorithm. According to the authors' analysis, if there are fewer ants, both the running time and memory usage will be reduced. It largely functions well for difficult problems.

In their article, Gupta et al. [10] concentrated on the target-based WSNs' inadequate connectivity and coverage. The authors employ a genetic algorithm to determine the node's precise location, which is crucial for target-based WSN. In this study, the meta-heuristic optimisation is applied using the bat method. This algorithm is used to assess the precision of WSN node localization issues. Meanwhile, the adoption of the bacterial foraging strategies of bacterial foraging optimisation has additionally improved the dominating bat algorithm.

When an earlier sensor breaks, Habib et al. [11] suggested using the more traditional simulated annealing approach to locate the new sensor nodes. The network's lifetime and coverage area are both extended by the suggested algorithm. The authors were focusing on enhancing restoration to get rid of sensor node overlapping areas in WSN.

The life span strategy was utilised by Hada et al. [12] to resolve the store-and-forward WSN problem. They worked on railway application. They have developed a resource-constrained store and forward WSN. The experimental findings demonstrate that the suggested algorithm offers a nearly ideal solution in a significantly shorter period of time. The report concentrated on constructing an ideal WSN, and it was suggested that future research focus on improving network performance.

Objective:

1. To study wireless sensor networks and its application.
2. To optimize the node location and investigate the issue related to energy and cost in a wireless sensor network.
3. To study various localization algorithms and provide a suitable/optimized solution for localization in a wireless sensor network.

Methodology:

- To study the related literatures
- Based on literature reviews, to discover, classify, and examine the existing algorithms.
- To evaluate and find out the research gap.
- To optimize the node localisation.
- To resolve the challenges based on the meta-heuristic algorithms such as Ant colony optimization (ACO), Artificial Bee Colony (ABC), Whale Optimization Algorithm (WOA), and Gray Wolf Optimization (GWO).
- To finalize the most suitable algorithm for the localization in wireless sensors network.

Conclusion:

As tracking the target is crucial for data tagging,military applications and a few health monitoring applications, localization is the core function of WSN. The paper offers a survey on the significance of localization, the factors that must be taken into account to monitor its efficacy, and the methods used by metaheuristics to optimise localization. A number of the metaheuristic algorithms used to improve the localization problem for metaheuristic were mentioned in the study. The localization problem can be optimised using a variety of methods, including the ant colony optimisation,bat algorithm, artificial bee colony, elephant herding algorithm, tree growth optimisation, etc. At last, a survey on the use of metaheuristic algorithms for localization is offered. With the help of several nature-inspired algorithms, meta heuristics are used to optimise location finding in wireless sensor network , and promising findings are discovered every day. Researchers may create new optimisation methods in the future to address the WSN's localization difficulty. One can develop new algorithms by learning from the shortcomings of a single metaheuristic.

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